United Nations ECE/TRADE/C/CEFACT/2018/23

Economic and Social Council

Distr.: General
19 February 2018

Original: English

Economic Commission for Europe

UNECE Executive Committee

Centre for Trade Facilitation and Electronic Business

Twenty-fourth session
Geneva, 30 April and 1 May 2018
Item 11 of the provisional agenda
Future challenges in trade facilitation and electronic business

Draft Transparency in textile value chains in relation to the environmental, social and human health impacts of parts, components and production processes

Summary

Clothing is one of the largest industries in the world economy, with its supply chains spreading across all countries, driven mostly by big retailers and traders that determine where to produce, what to produce, and at which prices to sell. The negative social and environmental impacts of the fashion industry have been well documented over the past few decades, demonstrating that these impacts mostly occur within the upstream portion of the supply chain.

The lack of complete and transparent information about where and by whom materials are sourced, transformed and assembled, the lack of transparency as to the effects on the environment and human health of practices and processes, along with the lack of transparency on working conditions across the supply chain are key gaps. Improving traceability has therefore become a priority for the industry, in order to increase its ability to manage its supply chains both more efficiently and sustainably.

This paper identifies basic principles, possible solutions, and provides recommendations for an international framework initiative on transparency and traceability for sustainability patterns in the clothing sector, in support of Sustainable Development Goal 12 on responsible production and consumption.

GE.18-02453(E)

1802453

Please recycle

I. Introduction

1. What is, in the ECE region, the incidence of purchases of textile and apparel that may incorporate parts and components coming from environmentally harmful production processes, with or without health consequences for workers and consumers? How does the textile industry relate to the concepts of transparency, traceability, supply-chain mapping and sustainable sourcing? Are there economic gains to reap for businesses becoming sustainable? Are there innovative IT solutions to facilitate textile value chains' transparency through traceability? Lastly, is there scope for recommending regulatory action on both the public and private sectors' side?.

2. In an attempt to provide a starting point to answer these questions, this paper surveys academic and policy-oriented literature on the relationship between the environmental, social and human health impacts of textile production and processing, on the one hand, and the extent to which information about such impacts reaches the final consumer.

3. More specifically, the paper is sub-divided into two main sections. Section I tries to depict the landscape of sustainability-related practices in the textile industry. It briefly reviews stylized facts about environmental, social and health impacts in the textile sector; explains how the concept of transparency in supply chain management translates into practical interventions such as traceability schemes and relevant tools; and provides notes on consumers' perspectives and IT innovative solutions to communicate information on sustainability performance along textile value chains. Section II summarizes case studies and theoretical analyses on opportunities and challenges linked to the decision, on the business side, to enhance transparency in their supply chains. The paper concludes with some considerations as to the opportunity and desirability of investing in a new UNECE recommendation on traceability for communicating environmental and health risks along textile value chains and down to the final consumer.

II. Textile value chains: environmental, social, and health impacts

A. Overview of the environmental impacts of the textile industry

4. Two major categories of environmental impacts of textile production and processing are the discharge of pollutants and the consumption of water and energy (UNEP 2014).

5. With regard to the discharge of pollutants, these can result in air, water and land pollution, and are mostly linked to the use of chemicals. However, while "air emissions are a minor but not negligible source of pollution; most of the chemicals and auxiliaries are released to waste water. Concerning the organic load, 20 – 100 g organic carbon/kg processed textiles are emitted, which is 15-250 times higher than emissions to air. Thus, emissions to water are predominant" (OECD 2004). The case of cotton is particularly telling. Cotton comprises 45 per cent of all fibres used within the global textile industry and there are health and environmental risks involved in farming and manufacturing practices (Kaye, 2013). The majority of growing operations use high levels of pesticides, which can settle into the soil and the water supply (Kemi, 2014).

6. With regard to energy consumption, it is widely recognized that the textile business plays a role in climate change by virtue of its considerable energy consumption. To meet its energy demand, the sector resorts to two distinct types of energy sources: indirect

emission sources (electricity) and direct emission sources (natural gas, cogeneration and diesel fuel). Reduction in greenhouse gas emissions associated with energy consumption can be achieved by various means, the main ones being energy efficiency, the rational use of energy consumption, and cogeneration (MED-CLEAN 27.

7. As discussed later in this paper, it is interesting to note that most of the interventions to enhance sustainability in textile production practices can bring economic benefits to business. The discharge of pollutants and wastes, for instance, represents an additional economic cost to the company. Indeed, inefficient processes lead to a loss of expensive chemicals, wastage of water and energy, while also giving rise to undesirable quality variations in industrial output (UNEP 1994).

8. Another important field of investigation to reduce environmental chemical impact concerns the raw materials tier. Improving partnerships between buyers, farms and SMEs in order to introduce innovative land and water management practices, could reduce chemical and energy usage and enhance production quality and health for workers and livestock. Also in this case, there is a need to track and trace data regarding consumption and performance improvement. This should involve the use of software and tools for the physical tracking and mapping of animals and the harvest involved in sustainable and ethical practices.

9. Moreover, a carbon capture good practice, with a large extension of tree plantations can constitute a corporate social responsibility (CSR) action for large enterprises, while helping farmers improve land management and reduce ground erosion, impacting the quality of production. Also, large companies and governments (coordinated actions and research programs) could help SMEs and farms to experiment using new technology and tracing methods to reduce chemicals in the supply chain.

B. Health risks, social risks, and consumers' approaches towards sustainability

(1). Health Risks

10. A number of studies and research initiatives undertaken by both institutional and academic stakeholders support the view that, besides the obvious potential to create occupational illnesses due to direct contact during handling of chemicals, certain chemicals incorporated in garments have direct negative consequences for their final users (UNEP 2014). In 2014, for instance, a report by the Swedish Chemical Agency revealed that 10 per cent of textile-related substances are of potential concern to human health (Kemi, 2014).

11. Of all the chemicals manufactured worldwide, approximately 25 percent are used in the textile industry. Furthermore, in the textile industry alone, which represents over 40 per cent of global manufacturing, China uses about 42 percent of the world's textile chemicals (Greenpeace, 2013).

12. Workers in the textile industry are exposed to chemicals that are linked to several kinds of cancers, including brain cancer, lung cancer, and stomach cancer. Chemical contact to skin and inhalation can lead to other serious health effects, while exposure to noise also represents a serious risk to workers (O Ecotextiles, 2013).

13. The *Associazione Tessile e Salute* (Textile and Health Association), based in Italy, reported in 2014 that harmful substances such as carcinogenic aromatic amines and heavy metals, were present in garments put on the market in Italy in the same year. Contextually,

Italian surveyed hospitals and clinics reported that 7 to 8 per cent of dermatological diseases were caused by textiles and footwear (Associazione Tessile e Salute, 2014[1]). This Association, established with the contribution of Universities and the Italian Medical Dermatological Association (SIDAPA), and with support of the Health Ministry, represents a good practice in helping industries to adopt standards and international rules for a sustainable chemistry in textiles. Its research activities have been fundamental in compiling the guidelines "Eco-toxicological requirements for clothing, leather goods, footwear and accessories"[2], developed in collaboration with the Italian Chamber of Fashion, and now serving as the main reference point for major brands and Italian SMEs to track chemical impact and engage suppliers towards impact reduction.

(2). Social Risks

14. The main social risks for a fashion firm are related to the respect of fundamental labour and human rights, freedom of association, equal opportunities, governance, anti-corruption and fair practices, fair competition, society and community development, and product and consumer-related health and safety. Moreover, the search for proximity to sources of raw materials have favoured the rapid transformation of supply chains. As a result, firms have endured increasing pressure from governments, consumers, and NGOs to extend CSR practices to their production lines, including not only first-tier, but second- and third-tier suppliers as well (Rinaldi & Testa, 2014).

15. The production of garments often outsourced to developing countries is subject to less stringent labor laws, allowing companies to benefit from cost efficiencies by taking advantage of workers, and avoiding paying them their country's minimum wage, let alone a fair living wage (Global Fashion Agenda & The Boston Consulting Group, 2017). The issue is not only limited to achieving a minimum wage, but also to gender equality issues, where women are paid less than men. Workers are forced to labor relentlessly under improper conditions, with negative health effects. A mother is working long hours at the factory, and she often has no choice but to bring her children to work, where they can suffer from developmental issues. Additionally, the lack of access to education in countries where such factories are located, has facilitated the employment of children within the textile industry. The abolition of child labour and forced labour sets out two fundamental rights promoted by the International Labour Organization (ILO) and represents a basic principle for the implementation of every CSR policy. From the point of view of labour rights, two fundamental conventions govern the issue: *ILO Convention no. 138 (1973)* on the minimum working age and *ILO Convention no. 182 (1999)* on the worst forms of child labour.

16. Several initiatives have been established to address such challenges, including Better Work, a program developed by the ILO and the International Finance Corporation (IFC). They work directly with factories to implement sound solutions, and provide support through guidance on minimum wages and financial incentives to encourage factories to create better working conditions (Better Work, 2017).

17. Another example is the establishment of self-assessment tools such as the Higg Index, developed by the Sustainable Apparel Coalition (SAC), which enables corporations to assess their performance against a set of established standards. The Higg Index evaluates social and labour impacts, waste levels and waste management systems, emission levels, and chemical use within factories to inform upper management on ways to develop products more sustainably (Higg Index, 2017).

[1] See: http://tessileesalute.it/en/about-us/studies-and-tools/

[2] See: http://www.cameramoda.it/media/pdf/linee_guida_en.pdf

18. Partnership and collaboration amongst all actors involved is an important approach to address social risks, as it can help to ensure benefits to both the business and society. Rather than a CSR department simply providing a donation in the form of philanthropy, where the company has little to no involvement in the distribution of the funds, a partnership allows there to be a sharing of value where tangible changes can be made (Keys, Malnight, & van der Graaf, 2009).

(3). Notes on consumers' behaviour towards sustainability

19. Reviewed literature suggests that consumers, in the majority of cases, are not aware of the potentially negative environmental and social impacts of their purchasing decisions. Against this general assumption, the factors shaping consumers' behavior and attitudes towards sustainability appear to have a direct relationship with issues related to enhancing transparency in textile supply chains. Such factors can become drivers of policy decisions from both the public and private sectors, particularly in relation to strategic decisions to invest in supply chain transparency.

20. In 2011, the Organization for Economic Cooperation and Development (OECD) carried out a survey on consumers' environmental behaviour. Information was collected from more than 12,000 households in Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland, and revealed that environmental attitudes matter and governments can have a role in forging them. Accordingly, a complex set of factors underpin people's decisions and habits, including knowledge, the availability of information, trust, the concerns of neighbours, levels of environmental activism, as well as education, income, and ownership status. Several findings of this study suggest that well-designed information campaigns and educational programmes can change behaviours. Moreover, while the survey confirmed that prices and costs can be hugely influential in household decisions, it also revealed an overall willingness to be green and to pay more for environmentally-friendly choices (OECD 2014).

21. More selective studies explore trade-off effects when looking at a consumer's desire to pay for a product. This trade-off can stem from a wide variety of factors, whether it be a company's commitment to the environment, or the quality of a given product (Feldman and Vasquez-Parraga 2013).

22. Research on consumer awareness trends confirmed that while some consumers are informed and aware of environmental and social issues connected to their purchases, others show little interest in sustainability aspects of fashion. Research within the industry suggested that there was room for the promotion of sustainability in the fashion supply chain, however consumers were rarely informed regarding the matter (Saicheua, Cooper, & Knox, 2011).

23. A 2014 study on US consumers revealed that, in the U.S. market, "[…] consumers' knowledge of environmental issues in the apparel industry, moral norms, expectations of ethical behavior, and attitudes towards patronizing apparel retail brands engaged in CSR were all important predictors of U.S. consumers' intentions to patronize socially responsible apparel retail brands" (Diddi, 2014). Additionally, "knowledge of environmental issues in the apparel industry and universalism values were found to influence consumers' expectations of retail brands ethical behavior" (Diddi, 2014).

24. Consumer behaviour towards clothing appears to be particularly complex and influenced by many different factors. Connell and Kozar (2014) report that in recent research on consumers' environmentally sustainable clothing behavior, the emphasis has been on the knowledge and attitudinal variables in encouraging the consumption of environmentally sustainable clothing. Recently, large brands' retailing networks are looking at potential impacts on the conversion rate, by piloting temporary shops or green corners in store networks and on e-commerce platforms.

C. Transparency in textile value chains

(1). General considerations

25. Global Value Chains (GVCs) are the main feature of international trade. GVCs rely on well-functioning transport, logistics, finance, communication, and other professional business services in order to operate smoothly. Many goods and services are now from 'everywhere' rather than 'somewhere'. It is thus vital for the future development of GVCs to have complementary trade policies consisting of a holistic approach to trade regulation, to facilitate and adjust to a world of GVCs (OECD 2013).

26. Approximately 80 per cent of textiles consumed in the EU, for instance, are imported from non-EU countries. It also appears that important information related to production methods and materials is not being carried along well enough from producer to consumer (Kemi, 2014).

27. Textile GVCs are particularly complex. As Lam and Postle (2006) mention, problems in the supply chain of clothing and textiles include short product life cycles, prediction errors, and lengthy lead-times when it comes to production. These authors report on the apparel and supply chain for Hong Kong, where a main issue is their geographical location in terms of distance to European and American consumers. As a result, there are minimum quantities requested, and this can lead to pressure for greater efficiencies and high competition.

28. It should also be kept in mind that the textile sector represents the first stage of value added manufacturing for low-income countries (Fukunishi, Goto, & Yamagata, 2013).

(2). Transparency through traceability, supply-chain mapping and sustainable sourcing

29. As suggested by Linich (2014), "transparency goes beyond gaining visibility into the extended supply chain. It is the process by which a company takes action on the insights gained through greater visibility in order to manage risks more effectively".

30. Traceability schemes or initiatives appear to be important tools to move towards more transparency in the management of GVCs, as well as to facilitate the flow of information. Traceability in supply chains can be defined as the ability to identify and track the path of a product or material component from raw material to finished good. This is a useful tool to understand and relay information about the transformation of products, parts, and materials throughout the value chain.

31. Traceability fits into a certification scheme by serving as a link between production and consumption in the market place. "A Guide to Traceability" was developed in 2014 in collaboration between the UNGC and The Business of a Better World. The Guide provides an overview of the importance of traceability for sustainability objectives across various industries. Accordingly, two models were identified that define the process of traceability in the textile industry: product segregation and mass balance.

32. Product segregation implies that certified materials and components are physically separated from non-certified materials and components at each stage through the supply chain.

33. Mass balance allows certified and non-certified materials to be mixed. The identified volume of certified material entering the value chain must be monitored and controlled and the same volume of certified product leaving the value chain can be sold as certified (UNGC 2014).

34. Supply-chain maps are geographical representations of the network of suppliers of a given firm. These maps mostly rely on innovative IT solutions to graphically represent the

movement of parts and components along value chains, and can be a helpful tool to enhance transparency in supply chain management (Zeeb 2013).

35. Finally, sustainable sourcing, for which transparency in supply chain management is a necessary pre-condition, mostly relates to the procurement policies put in place by firms in the selection of their suppliers (SAI 2013). Arguably, these policies depend on the availability of reliable information on the health and environmental impacts of inputs, processes, and production methods along value chains.

36. These and other initiatives to enhance transparency in textile value chains can bring several economic, social and environmental benefits. However, implementation efforts are often very demanding in terms of economic investments and technical knowledge needed to put them in place. Innovative IT solutions can help overcome these barriers towards effective implementation.

37. The implementation of free trade agreements across a greater number of countries can help to further protect the rights of workers. This can help to ensure that member countries adhere to a strict set of labor standards that are outlined in the legislation (ILO, 2017). A strict set of labor standards is also necessary to reduce the promotion of illegal practices by workers (i.e. the unauthorized capturing of animals). Understanding the geographical origins along the supply chain must also be underlined as it can affect the management approach and ways of approaching CSR (Fiaschi, Giuliani, Macchi, & Perrone, 2012).

38. Respecting ethical protocols is not only limited to human rights, but to those of animals as well. Live-plucking and force-feeding of geese for the use of down is a controversial issue in that performing such a task is still legal in several countries. The increase of regulations within the 2006 Animal Welfare Act, which outlines the promotion of welfare and the avoidance of harm towards animals, can serve to prohibit the performance of such processes on animals. Companies can also make use of third parties whose purpose is to provide the tracking and tracing of animal treatment within the supply chain, and who can maintain accuracy of the results provided. The International Down and Feather League Laboratory and Institute (IDFL) tests garments that are filled with both synthetic and natural materials, as well as those that are filled with down and feathers. IDFL provides audits and inspection services that provide clients with the information needed to trace the credibility of the source from which the textile filling has originated (IDFL, 2017). The Textile Exchange is an organization that works directly with the textile value chain to ensure a sustainable process from start to finish, and they have introduced numerous standards to which companies can adhere to, including The Responsible Down Standard (Textile Exchange, 2017).

39. Recycling, re-using and upcycling policies belong to the general framework and are necessary to improve the collection system, transparency, and safety on all final phases of products. That is for customer protection and to guarantee the output of a truly recycled product (i.e. green labels coming from a traced and audited system of remnants and unsold items). There are also health implications and transparency aspects about the source of materials. As for the second-hand market, tracing the origin and treatments of the sold product is a must. Labels should not be accepted without evidence of traceability notes and/or certification. QR codes, bar-codes, and GPS tools could help to inform and trace the collected and recycled products. An important social aspect of traceability impact is to consider ongoing technologies to combat criminal organizations that collect discarded garments and re-sell them without respect for hygienic practices, thus avoiding the progression to less well-off people.

(3) IT solutions to communicate information on environmental and ethical performances

40. The extent and complexity of textile supply chains makes it very hard for companies to collect accurate information about sources and relevant environmental/health risks and impacts. As a consequence, in recent years there have been a number of technological advancements that helped to cut costs and improve the quality and reliability of data. Linich (2014) reports the following examples of key technological advancements in this field, within and beyond the textile sector:

- **Assessment tools for use across the supply chain**. Rather than conducting on-site or third-party audits, companies can now track compliance or employment data using mobile technology. LaborLink, LaborVoices, and other service providers offer confidential surveys for factory, farm, and other supplier-level employees to voice concerns via SMS technology. Compared to traditional third-party audit services, SMS-based surveys offer the advantages of real-time data, confidentiality, and reduced costs. Muddy Boots Software, for instance, recently introduced its new Greenlight Assessments app, for use on Apple iPad® mobile devices with Muddy Boots's Quickfire self-assessment system, as a portable data-collection and data-sharing tool. Unilever uses the technology to track, in real time, how effectively its agricultural suppliers are complying with the company's Sustainable Agriculture Code.

- **Managing internal key performance indicators (KPIs) with external supplier data**. In response to the US Foreign Corrupt Practices Act (FCPA), Dodd-Frank Act, and UK Bribery Act, multinational businesses are required to collect information about relationships with suppliers in a global effort to thwart fraud and corruption. Many companies subscribe to due diligence services through companies like Dun & Bradstreet, MapleCroft, or LexisNexis, which provide access to databases containing information about businesses and individuals. New tools from companies like Aravo, Hiperos, and SourceMap go a step further by integrating those external information sources with internal KPIs or risk indicators. Some tools even integrate social, environmental, and other compliance metrics, helping companies visualize, anticipate, and preempt supplier-level risks.

- **Tracing individual products**. Some industries are beginning to track products from the manufacturer to the end consumer to help confirm quality and prevent fraud. For example, in anticipation of proposed federal and state "track-and-trace" legislation, 16 some pharmaceutical companies are employing new approaches pioneered by technology start-ups, such as printing each pill with a code that can be texted to a central telephone number to verify the product's integrity. Other companies have developed technologies for embedding near-infrared spectral fingerprints or tags containing inactive ingredients into pills. These technologies are helping pharmaceutical companies respond to product safety regulations, limit costly counterfeits, and provide customers with a greater sense of security.

- **Transparency to inform and engage end users**. Some companies voluntarily and publicly offer consumers visibility into their supply chains. A clothing maker, IceBreaker, provides a "barcode" with each product, which allows customers to use the company's website to trace the merino wool in the garment all the way back to the source—the sheep farm where the wool was produced.

41. Blockchain as a means of transforming the supply chain is another key consideration. Big IT companies, such as IBM have recently been working with multinational companies in the agri-food sector to trace where a given food has originated from, through the use of a blockchain. This shared ledger can help to identify all points along the supply chain (McDermott, 2017). Similar to how blockchain is being used to enhance transparency in the food industry, the use of this technology can be applied to the

garment industry to help track the origins of products, access real-time inventory levels, access where raw materials are sourced from, and provide operational efficiencies. The use of this technology is not only limited to products and services, but can also be used as a means of tracking staff along the supply chain through their qualifications (Casey & Wong, 2017). By having real-time data about employees, it facilitates the ability for companies to identify what and where are the pain points, thereby facilitating their ability to resolve them. If there is a work accident, the safety features, the operator, as well as his credibility can be quickly determined. The creation of a custom SKU Metadata Format (SMF) specific to the textile industry can be introduced as a means of retaining product information, product origins, product modifications, pricing variations, sizing codes, certifications, and any other additional information that may be needed to trace garments within the industry (Beckwith, 2017).

42. A mapping and tracing system is therefore important for CSR policies to create global supply chains with components coming from certified/traced ethical production. We can track a lot of data regarding local producers (i.e. from Africa villages), using clean and natural processes, while also measuring social impact. Systems and technological tools can help to improve animal safety (theft, predator attack, and contamination/infection). Some government agencies (i.e. Australian and New Zealand) have already introduced good practices for animal mapping and care on the territory. New technologies are also emerging for fire safety and to monitor seasonal chemical usage in the ground.

43. An important step towards a sustainable program for the clothing sector is to create a rating system with specific KPIs for companies that have started the traceability for environmental accountability processes, including adopting human rights and animal welfare good practices. The Life Cycle Assessment is an advisable tool to initiate internal rating systems, but the companies and brands may need a universally recognized system of account, rules, and KPIs. This aspect concerning the rating systems also has financial implications considering the interest of banking and financial institutions to rate ethical and green companies. Recently, some banks have decided to fund and give incentives to SMEs supporting sustainable investment and certification programs for the textile and clothing supply chain (i.e. Unicredit & CNMI sustainable funds/loans).

II. The business perspective on enhancing transparency in textile supply chains

A. Opportunities

44. As a general rule, investments aimed at improving sustainability of business operations allow companies to use fewer resources for a greater output. Furthermore, being an early adopter on environmental related causes is not only a good investment, but is also a way to distinguish themselves in a highly competitive space (eKinetics, 2010). This sub-section summarizes case studies on "greening" initiatives that brought economic gains to businesses in the textile sector in both developed and developing countries. The case of Nudie Jeans Co., a medium sized Swedish clothing company, suggests that supply chain transparency is a useful corporate tool. Consumers exposed to traceable supply chains were more willing to buy, while at the same time they were not interacting more or differently with Nudie representatives. The author argues that transparency improves comprehensibility and comparability; however it is far from certain if in practice this is enough to motivate consumers to pressure the company to make changes (Egels-Zandén & Hansson, 2015).

45. In 2005, Nike and Levi-Strauss published lists of their suppliers. Steps taken in this connection included developing new information systems to enable the two companies to

better track information about labour practices and introducing code monitoring systems, using both internal and external auditors (Doorey, 2011). The Cleaner Production Regional Activity Centre (CPRAC) reports about several successful firm-level initiatives, of which two examples are set forth below:

- First Textile, a company based in Turkey and engaged in the production of knitted textile, yarn, fabric-dyed textile and printed textile, realized the following gains from implementing cleaner production processes:

Environmental benefits	**Cost (Investment +Operational)**	**Annual saving**	**Payback period**
Reduction of water, energy and chemical consumption	USD0	USD58,340-32,370	immediate
Reduction of water and salt consumption	USD20,000	USD57,680	3 months
Reduction of steam and energy consumption Air pollution control	USD328,820	USD513,000	1 year

- A large public-sector textile factory in Egypt, producing 8,000 tonnes of raw fabric a year, realized the following gains:

COST-BENEFIT RELATIONSHIP				
Factory Department	**Action**	**Capital & Operation costs (€)**	**Yearly savings (€)**	**Payback period (months)**
Measures already implemented				
All	Steam condensate recovery	13,203.0	39,638.3	<4
	Upgrade insulation of steam and hot water networks	14,083.2	39,646.0	<5
	Improve storage facilities	0.0	6,689.5	Immediate
	Optimise chemical usage	0.0	10,269.0	Immediate
Fabric Pre-treatment	Counter current flow in Kyoto range	12,909.6	65,064.4	<3
Additional measures to be implemented				
Fabric Pre-treatment	Install automatic shut-off valves, Gaston County range	10,709.1	13,159.0	<10
	Recycling final wash water	8,802.0	41,442.8	<3
Yarn dyeing	Heat recovery from hot liquors	23,472.0	31,443.7	<9
Sub total		42,983.1	860,45.4	<6
OVERALL COST BENEFIT RELATIONSHIP		83,178.9	247,352.6	4

46. As can be seen in these two examples, savings from optimization of water consumption appear to be predominant.

47. The case of ISKOTM is also an interesting one. This company is part of SANKO TEKSTIL, the textile division of SANKO Group, and the only denim mill in the world to have been awarded both the Nordic Swan Ecolabel and the EU Ecolabel. As an active player in responsible innovation and sustainability, and as a member of the SAC, the brand is committed to saving water and energy by using filtration and treatment to clean the water during the manufacturing process and recycling it for other industrial purposes. 280,000 tons of water have been saved in 2016 as a result of new finishing technologies, while over 1.4 million kWh of energy have been saved due to automated systems installed in the weaving halls. Furthermore, carbon emissions have been reduced by 900 tons per year. Heat and steam generated during the production cycle are captured and re-used, and this minimizes energy consumption that results in annual energy savings of 86,000 kWh, while reducing carbon emissions by 56 tons/year. Patented technologies allow fabrics to perform differently and help final consumers to make more sustainable choices, another key argument when it comes to responsibility.

48. In sum, the existence of clear economic gains and the fact that consumers in key export markets react to GVC transparency initiatives, fully support the preliminary conclusion that on the side of the firm, it would be economically meaningful to convey information about improvements in environmental performance to both intermediaries and final customers.

B. Challenges

49. Conveying complex information along complex supply chains can be expensive and can imply investments in infrastructure, human capital, and technological knowledge. In addition, abiding by new firm-level standards in the context of a traceability scheme can be particularly burdensome on the side of smaller suppliers. However, the present paper is limited to considerations related to transparency in supply chain management, hence abstracting from the typical challenges related to compliance with the substantive requirements of private and 'public' standards as such, for instance on environmental performance (Von Hagen & Alvarez, 2011).

50. The WTO and the OECD (2013) provide an analysis of ways forward to overcome broader supply chain costs in the textile sector in the context of the Aid for Trade initiative. Their study identifies four drivers for Aid For Trade assistance: encouraging overall development of the textile sector, promoting preferential utilization, supporting social upgrading in the global supply chain, and supporting vertical integration between apparel and textile sectors.

51. Finally, while technology can help cut the costs involved in enhancing supply chain transparency, some authors contend that the expectations associated with transparency policies are often unrealistically high. Accordingly, transparency schemes can help to cope but not solve social and environmental problems that are associated with production and consumption trends of advanced industrial societies (Dingwerth & Eichinger, 2010).

C. Recommendations

52. While there may be an underlying assumption that there is a strong awareness level with respect to the way textiles and clothing are produced, this is not the case. Recent studies indicate that despite growing pressure on the apparel industry to adopt CSR practices, there is still some confusion among consumers who strive for more sustainable

consumption practices, on their actual requirements, and on their implications. In fact, common recommendations from the group of experts engaged in the development of this paper are as follows:

- the need to conduct diagnostic work on transparency and traceability in the textile value chain, including the mapping of requirements for traceability systems.

53. Furthermore, institutions and firms are required to invest more on education, training, and communication (White, Nielsen, & Valentini, 2017). Upper-level positions (i.e. management and finance) are a key target and are in need of assistance to address the lack of awareness. Moreover, education is needed to better establish what are considered good practices in the traceability and sustainability of textile supply chains. It is not only a way of informing people of the visibility issues along the supply chain, but also a means of teaching better practices and how to incorporate sustainability in their operations. Educating designers is also necessary as they are the creative force and the future of the fashion industry. Social media posts by influencers and ambassadors that have a large following can play a significant role in creating positive changes to a large audience in a short amount of time. Better informed consumers can lead to greater pressure on manufacturers and supply-chain partners in terms of product enforcement and sustainable production. Experts pointed out to:

- the need for communication to governmental organizations, industry corporations, and consumers when it comes to the role of transparency and traceability for sustainable textile value chains;
- the need for education and training targeting designers and high-level management of the fashion industry on responsible production approaches for the sector.

54. Engagement of the business sector is not only necessary for viable changes to be made, it is a smart business strategy. Manufacturers with greater openness builds trust with companies, and companies with greater openness builds trust with the public. This creates positive associations in the mind of the consumer, who will more willingly purchase from the transparent company than from a closed-off competitor. A company that is incorporating social and environmental efforts, and operating in a greener and more sustainable way will benefit from positive public relations. Furthermore, investments in sustainable sourcing, supply-chain mapping, and people, will yield greater productivity and better results. Additionally, there is the need for sustainability to be democratic. Ultimately, this translates into increased business, higher profits, and greater economic gain. Experts pointed out to:

- the need for the business sector to invest in sustainable sourcing and supply chain mapping as a smart business strategy and a way to build trust with consumers.

55. Standards, certifications, and a regulatory framework are needed to address current gaps and the availability of tools. The use of third party standards in addition to one's own, is a way to gain credibility. Greenpeace Detox and Zero Discharge of Hazardous Chemicals (ZDHC) are initiatives that bring awareness to the dangers associated with chemical use, as well as applications towards safer usage methods within the textile industry. The use of product identifiers including Universal Product Codes (UPC) is common practice in associating a numeric identifier and barcode with a specific product, and is useful in removing consumer confusion towards labels and products. RFID tags and NFC tags are often placed in the interior tags of garments, and can provide the wearer with information on product components, provide information on stock levels, and also serve as an anti-theft device. Sustainable public procurement criteria for the textile sector focusing on environmental, social, and health criteria, can also have positive effects on the sustainability of production and consumption practices in the sector. Experts pointed out to:

- the need to harmonize existing standards, certifications, and regulatory frameworks to help tackle producer and consumer confusion towards multiple approaches;
- the need to use standardised information and auditing approaches according to strict rules.

56. The use of IT applications on smart devices can help to better engage consumers in the actions of the company, and provide insights into the origins of the textiles and garments. From a company point of view, when considering a switch from a large corporation to small farmers, technologies that are smart, simple, and effective are essential. Having a closed system that contaminates the well-defined ones is a constraint in using IT towards greater transparency. As such, it is necessary to separate the two systems to better isolate and target those that are in need of assistance. Moreover, big data and predictive analytics can be used to help start designing best practices. Data mining can be useful in structuring results, while excluding any goods that stem from unknown sources. More recently, there has been a lot of buzz around the application of blockchain technology. As mentioned in section C above, the use of this technology can help to better track the origins of products and provide operational efficiencies. The use of encryption provides for a secure system, and the information stored in the ledger is tamper-proof. Blockchain can help create a shared common ground, through information nodes with each contribution serving an important role (i.e. a certification body or an accreditation body that can do routine automated audit checks for you). LOOMIA, a start-up that has developed a smart fabric and a flexible circuit (The LOOMIA Electronic Layer) that responds to the senses (i.e. touch) and environmental changes, is another application where technology has been applied to garments and data has been collected (LOOMIA, 2017). The use of their LOOMIA Tile leverages blockchain technology to ensure the secure exchange of data, and the authenticity of products (Lederer, Maxey, Ucar, Liriana & Paul, 2017). The creation of partnerships and alliances with innovative start-ups working on sustainability can also be beneficial, as well as the use of fashion accelerators to help back socially and environmentally innovative start-ups that have potential. Experts pointed out to:

- the need to support innovative business solutions, IT developments (including blockchain), and smart devices to advance transparency in textile value chains and consumer awareness and engagement;
- the need to sustain accelerators and startups working on social and environmental innovation in the clothing industry.

III. Concluding remarks on the need for a new international framework initiative: Textile4SDG12

57. The literature reviewed and the experts' discussions reflected in this paper fully support the case for an international framework initiative (i.e. a framework agreement or a policy recommendation with guidelines) on enhancing transparency in textile value chains: Textile4SDG12. An international framework initiative of general application would be more appropriate than a standard due to the high concentration of patent-protected new technologies in relation to the various GVC transparency tools reviewed in this paper.

58. Indeed, both governments and companies, can play a crucial role in raising awareness and enhancing supply chain transparency. As to the role of governments, it appears that they can for instance support the reinforcement of environmental attitudes in consumers and businesses. For as much as variables such as trust and education matter in forging such attitudes, governments can invest in education programmes and awareness-raising campaigns. As confirmed by the OECD (2014), such initiatives lead to measurable

impacts in the attitudes of consumers and enterprises towards sustainable sourcing and other environmental and health issues. For companies, the existence of economic gains arising from the implementation of cleaner and healthier production practices, coupled with consumers' positive reactions to being informed about environmental and health impacts, supports the view that enhancing supply chain transparency can be a win-win situation.

59. Against these general considerations, however, development-related concerns should not be left behind, and due assistance should be provided to suppliers who lack the financial and human means to better communicate information on their sustainability performance. An international framework initiative should explicitly mention these concerns, and propose solutions, including financial incentives, to overcome the relevant challenges.

60. Further, as recalled by UNEP (2014), companies and governments should act in concert to enhance supply chain transparency and the overall environmental performance of the textile sector through research, training, information exchange, and communication. Whereas at the firm level the use of industry guidelines and self-regulatory procedures can have significant impacts, at the government level policy formulation should be consistent and oriented towards a preventive cleaner production approach, and also consider incorporating the monitoring and reporting requirements as part of such a policy framework.

61. A harmonized and internationally consistent approach to public regulations in this sector would thus be highly desirable. An international framework initiative reaching out far beyond the UNECE Region and conveying key stakeholders around the same table, could perfectly serve that purpose, and help countries draw together their initiatives and approaches to enhance transparency in textile GVCs.

62. An international framework initiative could foster innovation, improvements, and price reductions in the IT tools used for supply chain mapping, traceability, and sustainable sourcing. It would create momentum for new investments in these technologies, while at the same time avoiding the risk to create a rigid framework for stakeholders to adopt one or another of these technologies. However, such an initiative should encourage interoperability in relation to such new technologies with a view towards avoiding inefficiencies, overlaps, and losses.

63. A new framework initiative of a general nature would also serve the objective of fostering the international debate on the necessity to tackle negative health, social and environmental impacts of textile-related operations. In this connection, efforts to improve transparency in textile supply chains would also be of utmost relevance in the framework of the achievement of the Sustainable Development Goals of the United Nations Agenda 2030. It would in particular make a significant contribution to SDG 12, which calls for responsible consumption and production patterns.

List of references

Associazione Tessile e Salute. Studies and Tools. (2012). Retrieved from: http://tessileesalute.it/en/about-us/studies-and-tools/).

Beckwith, C. (2017). How Blockchain Could Boost the Fashion Industry. Business of Fashion. Retrieved from: https://www.businessoffashion.com/articles/opinion/op-ed-how-blockchain-could-boost-the-fashion-industry

Better Work. (2017). Our Strategy. Retrieved from: https://betterwork.org/our-work/our-approach/#1474820075262-02200c90-8081

Casey, M.J., & Wong, P. (2017). Global Supply Chains Are About to Get Better, Thanks to Blockchain. Harvard Business Review. Retrieved from: https://hbr.org/2017/03/global-supply-chains-are-about-to-get-better-thanks-to-blockchain

CKinetics. (2010). Retrieved from: http://www.ckinetics.com/publications/export_textile.htm

Connell, K.Y.H., & Kozar, J.M. (2014). Environmentally Sustainable Clothing Consumption: Knowledge, Attitudes, and Behavior.

Diddi, S. (2014). Understanding ethical consumption decisions: The role of values, attitudes and expectations in the apparel purchasing context.

Dingwerth, K., & Eichinger, M. (2010). Tamed Transparency: How Information Disclosure under the Global Reporting Initiative Fails to Empower. Global Environmental Politics, 10(3), 74-96. Retrieved from: http://www.glogov.org/?pageid=4

Doorey, D. J. (2011). The transparent supply chain: From resistance to implementation at Nike and Levi-Strauss. Journal of Business Ethics, 103(4), 587-603. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1916325

Egels-Zandén, N., & Hansson, N. (2015). Supply chain transparency as a consumer or corporate tool: The case of Nudie Jeans Co. Retrieved from: http://gup.ub.gu.se/publication/210950-supply-chain-transparency-as-a-consumer-or-corporate-tool-the-case-of-nudie-jeans-co

Feldman, P.M., & Vasquez-Parraga, A.Z. (2013). Consumer social responses to CSR initatives versus corporate abilities. Journal of Consumer Marketing, 30(2).

Fiaschi, D., Giuliani, E., Macchi, C., & Perrone, O. (2012). Corporate social responsibility and human rights abuses: a comparison of the strategies adopted by advanced country and BRIC multinationals. Notizie di Politeia, 28 (106), 34-54. Retrieved from: http://www.politeia-centrostudi.org/doc/Selezione/106/3.%20Fiaschi,%20Giuliani,%20Macchi%20Perrone.pdf

Fukunishi, T., Goto, K., & Yamagata, T. (2013). Aid For Trade And Value Chains In Textiles And Apparel. OECD/WTO/IDE-JETR. Retrieved from: http://www.wto.org/english/tratop_e/devel_e/a4t_e/global_review13prog_e/textles_and_apparel_28june.pdf

Global Fashion Agenda & The Boston Consulting Group. (2017). Pulse of the Fashion Industry. Retrieved from: https://www.copenhagenfashionsummit.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf

Greenpeace. (2013). Chemicals Substitution in Textile Industry: Implementing Chemical Policies Into the Textile Supply Chain. Retrieved from: http://www.greenpeace.org/china/Global/china/publications/others/2013/20130325-GP-ENG.pdf

Higg Index. (2017). Sustainable Apparel Coalition. Retrieved from: http://apparelcoalition.org/the-higg-index/

IDFL. (2017). About IDFL Laboratory and Institute. Retrieved from: http://www.idfl.com/about/

ILO. (2017). Free Trade Agreements and Labour Rights. Retrieved from: http://www.ilo.org/global/standards/information-resources-and-publications/free-trade-agreements-and-labour-rights/lang--en/index.htm

Italian Chamber of Fashion. (2015). Eco-toxicological requirements for articles of clothing, leather goods, footwear and accessories. Retrieved from: http://www.cameramoda.it/media/pdf/linee_guida_en.pdf

Kaye, L. (2013). Clothing to dye for: the textile sector must confront water risks. The Guardian. Retrieved from: https://www.theguardian.com/sustainable-business/dyeing-textile-sector-water-risks-adidas

Kemi. (2014). Chemicals in textiles. Swedish Chemical Agency. Retrieved from: https://www.kemi.se/files/8040fb7a4f2547b7bad522c399c0b649/report6-14-chemicals-in-textiles.pdf

Keys, T., Malnight, T.W., & van der Graaf, K. (2009). Making the Most of Corporate Social Responsibility. McKinsey. Retrieved from: http://www.mckinsey.com/global-themes/leadership/making-the-most-of-corporate-social-responsibility

Lam, J.K.C., & Postle, R. (2006). Textile and apparel supply chain management in Hong Kong. International Journal of Clothing Science and Technology, 18(4).

Lederer, S., Maxey, M., Ucar, E., Liriana, J., & Paúl, M. (2017). LOOMIA Tile. A Decentralized Platform for Identity and Personal Data. Retrieved from: https://github.com/LOOMIA/loomia/blob/master/LOOMIA_whitepaper.pdf

Linich, D. (2014). The path to supply chain transparency. A practical guide to defining, understanding, and building supply chain transparency in a global economy. Retrieved from: https://dupress.deloitte.com/dup-us-en/topics/operations/supply-chain-transparency.html

LOOMIA. (2017). Our Technology. Retrieved from: https://www.loomia.co/token https://github.com/LOOMIA/loomia/blob/master/LOOMIA_whitepaper.pdf

McDermott, B. (2017). Blockchain Unleashed: IBM Blockchain Blog. IBM. Retrieved from: https://www.ibm.com/blogs/blockchain/2017/09/improving-confidence-in-food-safety-with-ibm-blockchain/

(OECD 2004). Emission Scenario Document on Textile Finishing Industry. (2004). Retrieved from: https://echa.europa.eu/documents/10162/16908203/pt9_oecd_esd_no_7_textile_finishing_industry_en.pdf/2d6bb902-83cc-4ff1-94ef-6e8fb2aab978

(OECD 2013). Trade Policy Implications of Global Value Chains. (2013). OECD http://www.oecd.org/sti/ind/Trade_Policy_Implicatipns_May_2013.pdf

(OECD 2014). Greening Household Behavior: Overview from the 2011 Survey- Revised edition, OECD Studies on Environmental Policy and Household Behaviour, OECD Publishing.

(OECD, World Bank and WTO). (2014). OECD, WorldBank Group and WTO. Global Value Chains: Challenges, opportunities, and Implications for Policy. Retrieved from: http://www.oecd.org/tad/gvc_report_g20_july_2014.pdf

O Ecotextiles. (2013). Retrieved from: http://www.oecotextiles.com/index.php

Rinaldi, F.R., & Testa, S. (2014). The Responsible Fashion Company. Greenleaf Publishing. Print.

Saichcua, V., Cooper, T., & Knox, A. (2011). Public Understanding Towards Sustainable Clothing And The Supply Chain.

Textile Exchange. (2017). About Us. Retrieved from: http://textileexchange.org/about-us/

(UNEP 1994). Cleaner Production In The Asia Pacific Economic Cooperation Region.

(UNEP 2011). The Chemicals in Products Project: Case Study of the Textiles Sector prepared by United Nations Environment Program DTIE / Chemicals Branch. (2011). Retrieved from: http://www.unep.org/chemicalsandwaste/Portals/9/CiP/CiPWorkshop2011/CiP%20textile%20case%20study%20report_21Feb2011.pdf

(UNGC 2014). A Guide To Traceability. A Practical Approach to Advance Sustainability in Global Supply Chains. United Nations Global Compact. Retrieved from: https://www.bsr.org/reports/BSR_UNGC_Guide_to_Traceability.pdf

Von Hagen, O., & Alvarez, G. (2011). International Trade Center (ITC). The Impact of Private Standards on Global Supply Chains.

White, C.L., Nielsen, A.E., & Valentini, C. (2017). CSR research in the apparel industry: A quantitative and qualitative review of existing literature. Corporate Social Responsibility and Environmental Management, 24.